

## Original Research Article

### A Study on some biological aspects of Giant snakehead fish (*Channa micropeltes*) in Huai Suea Ten wetland site in Thailand.

#### Abstract

This research was aimed to study on biological aspects of giant snakehead fish (*Channa micropeltes*) in Huai Suea Ten wetland site, Nam Phong District, Khon Kaen Province in Thailand between April, 2017 and March, 2018. Thirty-six fish species belonging to 17 families were observed at 10 sampling sites. Three Channidae fishes, namely snakehead fish (*Channa striata*), giant snakehead fish (*Channa micropeltes*), and forest snakehead fish (*Channa lucius*), belonging to the family Channidae were reported. A total of 230 giant snakehead fish were found in this survey which consisted of 118 males and 112 females. The sex ratio (male: female) was 1: 0.95. The gonadosomatic index value of the female ( $0.79\pm 0.05\%$ ) was higher than that of the male ( $0.25\pm 0.08\%$ ). The body length and body weight of a total of 230 giant snakehead fish observed in this study showed the average of a total body length was  $43.71\pm 11.72$  cm; and the average of the body weight was  $448\pm 173$  g/fish. The condition factor of giant snakehead fish observed in 12 months were in a range of 0.45-0.74 for the male and 0.39-0.70 for the female. The ratio of the body and intestinal length of giant snakehead fish was as 1: 0.70. The stomach digesta components, expressed as the percentages of a whole stomach content weight of this fish species consisted of 51.8% of fish fillet, 30.3% of small fish and 17.9% of digested digesta.

#### Introduction

Huai Suea Ten wetland site is located in Nam Phong District, Khon Kaen Province where is in the northeast of Thailand. Huai Suea Ten wetland is considered as the aquaculture areas that are the main animal protein source for people who live in Khon Kaen province. Therefore, this wetland has been paid attention by researchers. Sri and Pornpongrungrueng (2013) studied Huai Suea Ten wetland was abundant in both plants and aquatic plant along the water-course bank. However, the native fish species; especially giant snakehead fish, and their biological aspects have not studied yet.

Giant snakehead fish (*Channa micropeltes*) belongs to Channidae family together with *Channa striata*, which are fresh water, air breathing, carnivorous fish, which are a valuable source of protein throughout the Asia Pacific region and they are indigenous to many tropical and sub-tropical countries including Thailand (Mohsin and Ambak, 1983). In terms of the ecology system, the snakehead fish is on the top of the food chain. In Thailand, it is one of the major fish species caught by the local

37 fisherman because it is a high value fish species in the markets. In addition, the juvenile of giant  
38 snakehead fish has become highly demanded as the small-scale farmers still count on the traditional  
39 fish culture by catching the fish juvenile from the nature. Consequently, the invasion of the ecology  
40 system in Huai Suea Ten wetland by those farmers takes place and become an issue recently. The  
41 overfishing is able to cause the imbalance of the ecology system in Huai Suea Ten wetland.  
42 Nevertheless, the information is limited.

43 It was necessary to understand the biological aspects of giant snakehead fish as a fundamental  
44 information for both of the conservation of snakehead fish and the researches to develop the  
45 snakehead fish culture. This research was aimed to study certain biological aspects, including sex  
46 ratio, relationship between body weight and length, gonadosomatic index, condition factor, and  
47 stomach content of Giant snakehead fish (*Channa micropeltes*) in Huai Suea Ten wetland site in  
48 Thailand.

49

## 50 **Materials and methods**

### 51 **1. Study area**

52 Huai Suea Ten wetland site is located in Nam Phong District, Khon Kaen Province where is  
53 in the northeast of Thailand. It lies between latitude 16°46' 5"N and longitudes 102° 46' 9" E. It  
54 covers approximately 7,000 km<sup>3</sup> and this area is considered to be economically important for people  
55 who live in Nam Phong District, Khon Kaen Province. There are three seasons namely, raining, and  
56 winter and summer. The annual averages of temperature, humidity and raining volume are  
57 approximately 27.5 °C, 74%, and 1,500 mm., respectively. The sampling site was divided into 10  
58 sites such as A, B, C, D, E, F, G, H, I, and J (Figure 1) based on the local fishing pier in Huai Suea  
59 Ten wetland.

### 60 **2. Sample collection**

61 This research period was 12 months (an annual survey study) which started from April, 2017  
62 to March, 2018. The samples such as Channidae fish and other fish species, water were collected  
63 monthly (sampling frequency). The depth and fish habitat in each sampling site were observed and  
64 recorded. The fishes were caught by our research team using the fish nets and also obtained from the  
65 local fishermen of each sampling site. The fishes were identified and unknown species were collected  
66 to be identified later. The giant snakehead fish was collected to be used for the other studies in the  
67 aquaculture laboratory in Khon Kaen University, Thailand. The collected fish samples were fixed in  
68 the 10% formaldehyde solution.

### 69 **3. Water collection and analysis**

70 The water samples (100 ml) were randomly collected at each sampling site with triplicates.  
71 The samples were kept in 4 °C until analysed. Water quality parameters such as temperature, dissolve  
72 oxygen (DO), and pH were measured in each site using Multi meter (YSI model 30A, YSI incorporate,  
73 Ohio, USA) and turbidity was measured using secchi disk. In addition to those parameters, the water

74 samples were collected to store in the glass bottles for the hardness and alkalinity measurements in the  
 75 laboratory of aquaculture, Faculty of Agriculture, Khon Kean University, Thailand. The hardness and  
 76 alkalinity measurements of the collected water were conducted according to the method of Boyd  
 77 (1979).

78

#### 79 **4. The experimental procedure**

##### 80 **4.1 Species identification**

81 All fishes collected from the all sampling sites were identified for the species according to  
 82 Nelson (1994). The collected snakehead fish with perfectly physical appearance were measured for  
 83 the average of the total **body length and body depth** ratio according to the method of Hubbs and  
 84 Lagler (1947).

##### 85 **4.2 The gender identity and sex ratio (male: female)**

86 The fish collected from each month were identified the gender by examining the external and  
 87 internal sexual organs. The external sex appearance in Giant snakehead fish of male and female  
 88 seemed similar; however, the body size of the male generally bigger than the female. The pelvic and  
 89 anal fins of the female were slightly shorter than that of the male. During the pairing season, the  
 90 abdomen of female was wider than that of male. Additionally, the urogenital pore of female turn pink,  
 91 the body color of the male became darker than usual. The internal sex appearance, two lobes of ovary  
 92 were found in the body cavity of female and two spermatic tubes were found the body cavity of the  
 93 male. The number of all identified fish were calculated for the sex ratio and tested for the statistical  
 94 difference using Chi-square test (Snedecor and Conbran, 1967). The hypothesis of this study was that  
 95 the sex ratio (male: female) was assumed as 1: 1. The data would be expressed as a monthly average  
 96 and an annual average of the sex ratio. Lastly, the sex ratio of each month would be compared in  
 97 order to be determined whether the sex ratio varied with the specific seasons and areas. The equation  
 98 used in this study:

99

$$100 \quad X^2 = \frac{(O-E)^2}{E}$$

101

102 Where:  $X^2$  = Chi – square of the sex ration (male: female)

103 O = the number of male or female was observed (Observed frequency).

104 E = the number of male or female which was expected to be observed (Expected  
 105 frequency).

106

##### 107 **4.3 The relationship between body weight and body length**

108 The individual male and female fish were measured for the body weight and total body length.  
 109 The values of the body and total body length would be calculated for the relationship between body

110 weight and length that was expressed as the quadratic equation and the coefficient of determination  
 111 ( $R^2$ ), based the method of Lagler (1970).

112

$$113 \quad W = aL^b$$

$$114 \quad \text{or } \log W = \log a + b \log L$$

115 Where: W = body weight

116 The equation of logarithm was performed:

$$117 \quad \log W = \log a + b \log L$$

118 Where: W = body weight (g/fish),

119 L = total body length (cm/fish),

120 a and b are the constant value

121

122 After the quadratic equation and the coefficient of determination ( $R^2$ ) were calculated, these  
 123 were examined whether they were able to describe the dependent variable values (Y) properly,  
 124 according to the t equation.

125

$$126 \quad t = \sqrt{\frac{(n-2)R^2}{1-R^2}}$$

127

128 The calculated value of t would be compared to the t value in the t-distribution table at  $t_{0.05} (n-$   
 129  $2)$ . In case, the calculated value of t was higher than that of t in the t-distribution table, it indicated  
 130 that there was significant relationship between the body weight and body length.

131

#### 132 **4.4 Gonadosomatic index (GSI)**

133 The fish were dissected to collect to gonadal organ which was then weighed using a balance  
 134 (Sartorius ED124S analytical balance, Goettingen, Germany). The weight of gonad organ was  
 135 calculated for GSI, according to Benfey and Sutterlin (1984):

136

$$137 \quad \text{GSI} = \frac{\text{Gonadal weight of fish} \times 100}{\text{Fish body weight}}$$

138

139

140 The average of a monthly GSI value collected monthly would be calculated to compared to  
 141 the average of an annual GSI value in order to estimate the highest development of the gonad in a  
 142 year (a year-round range).

#### 143 **4.5 The condition factor**

144 The body weight and total body length of fish sampled from each month were calculated as  
 145 the condition factor which is expressed as expressed as a mean value  $\pm$  standard deviation, according  
 146 to Swingle and Shell (1971).

147

$$148 \quad K = 100 W/L^3$$

149 Where: K = the condition factor

150 W = the fish body weight (g)

151 L = the total length (cm)

152

#### 153 **4.6 The relationship between the body and intestinal lengths and stomach content index**

154 The fish samples were dissected to collect both the tissue and the content/digesta in a whole  
 155 digestive tract including stomach and intestinal contents. The length of intestine was measured for a  
 156 ratio and relationship between the length of digestive tract and the total body length of fish (Nikolskii,  
 157 1963). The value is expressed as expressed as a mean value  $\pm$  standard deviation. The digesta was  
 158 examined for the feed components under the microscope with (5x) using the occurrence method,  
 159 based on Hyslop (1980), so as to sort the type and number of feed components, of which values were  
 160 expressed as **percentage (%) of a whole stomach digesta** (100%) as the digesta weight.

161

162

$$163 \quad Li = a Lt^b$$

$$164 \quad \text{or} \quad \log Li = \log a + b \log L$$

165 where: Li =Length of intestine (cm)

166 Lt = total body length (cm)

167 a and b are the constant values.

168

169

## 170 **Results and discussion**

### 171 **The observation of study area and water quality**

172 The water-course bank of Huai Suea Ten wetland was brooked and there was the abundance  
 173 of both plants and aquatic plant along the water-course bank. The ranges of water quality (DO = 2.5-  
 174 5.0 mg/L; pH = 5.5-5.7; temperature = 23-32 °C; alkalinity = 54-66 mg/L; hardness = 57-59 mg/L;  
 175 and turbidity = 30-130 mg/L) measured in all sampling sites in Huai Suea Ten wetland was  
 176 considered in the normal range for the natural fishes.

### 177 **2. Fish species identification and diversity**

178 A study on the general characteristics and taxonomy of fishes is used as the significantly  
 179 important indicators of the fish habitats, fish existence and fish behaviors (Wootton, 1998) that is a

180 fundamental information for both of the conservation of certain invaded species and the researches to  
181 develop the aquaculture industries.

182 Based on the results of the annual survey from April, 2017 to March, 2018 in Huai Suea Ten  
183 wetland site is located in Nam Phong District, Khon Kaen Province, 36 fish species belonging to 17  
184 families were observed in 10 sampling sites (Table 1). The family Channidae, three fishes such as  
185 snakehead fish (*Channa striata*), giant snakehead fish (*Channa micropeltes*) (Figure 2), and forest  
186 snakehead fish (*Channa lucius*), were observed in this survey. In addition to the giant snakehead fish  
187 which was the target fish found in this survey, the Cyprinid fishes were the most diverse among fishes  
188 that was counted as 11 species. Three of them belonged to the subfamily Rasborinae; and the others (8  
189 fishes) belonged to subfamily Cyprininae. The family of Anabantidae fishes was in the 2<sup>nd</sup> place  
190 which was surpassed by the group of Cyprinid fishes. There were five species found in this survey.  
191 Further, two families of fishes, namely Siluridae and Cobitidae, consisted of two species of each  
192 family were found. The others families including Clariidae, Notopteridae, Pristolepidae, Cichlidae,  
193 Eleotidae, Belonidae, Tetrodontidae, Mastacembelidae, Symbranchidae, Parmbassidae and Nandidae,  
194 which composed of only one species of each family. In Thailand, 10 fish species belonging to family  
195 Channidae; and the giant snakehead fish is the biggest snakehead fish in this family.

#### 196 **The sex ratio (male: female) of giant snakehead fish**

197 According to the annual sampling of giant snakehead fish, a total of 230 giant snakehead fish  
198 were found in this survey which consisted of 118 males and 112 females. The sex ratio (male: female)  
199 was 1: 0.95 (Table 2). The sex ratio was hypothesized that the ratio of the male was equal the female  
200 as 1: 1 at 95% of the confident interval. As a result of Chi-square test in the annual survey, the  
201 calculated value of Chi-square (9.465) was lower that the table value of Chi-square (19.68; df = 11),  
202 indicating there was no a significant difference in the sex ratio of giant snakehead fish ( $p > 0.05$ ).  
203 Based on the result of the monthly survey, the calculated values of Chi-square were lower that the  
204 table value of Chi-square (3.84; df = 1), indicating there was no a significant difference in the sex  
205 ratio of giant snakehead fish ( $p > 0.05$ ).

#### 206 **The relationship between body weight and body length**

207 There was a significantly positive relationship between the body length and body weight of  
208 230 giant snakehead fish ( $R^2 = 0.696$ ) collected from April, 2017 to March, 2018 in Huai Suea Ten  
209 wetland (Figure 6).

#### 210 **Gonadosomatic index (GSI)**

211 The gonadosomatic index (GSI) of each gender collected monthly was used to indicate the  
212 maturity period of giant snakehead fish in a year by comparing the value in each month. The GSI of a  
213 total of 230 giant snakehead fish observed in 12 months showed that GSI of 118 males was in a range  
214 of 0.140-0.361%, and the highest value (0.36%) and lowest of GSI values were found in December,  
215 2017 and April, 2018, respectively (Figure 4). The GSI of 112 females was in a range of 0.299-  
216 1.788%, and the highest value (1.79%) and lowest of GSI values were found in June, 2017 and

217 December, 2018, respectively. In comparison, the GSI value of the female was higher than that of the  
218 male that indicates the gonad (ovary) of female is greater level of gonad development, in terms of the  
219 weight, than that (sperm) of male.

#### 220 **The condition factor**

221 The condition factor is an indicator of the health status and maturity which are commonly  
222 varied with the season and several factors such as fish species, fish body size, fish gender, food  
223 availability and the quality of environment (Nikolskii, 1963). The body length and body weight of a  
224 total of 230 giant snakehead fish observed in this study showed that the longest and shortest body  
225 lengths of fish were 14.3 and 73.3 cm, respectively; and the average of a total body length was  
226  $43.71 \pm 11.72$  cm. The heaviest and lightest body weights of fish were 125 and 1,254 g/fish,  
227 respectively; and the average of the body weight was  $448 \pm 173$  g/fish (Table 3). The condition factor  
228 (K) of a total of 230 giant snakehead fish observed in 12 months showed that the condition factor of  
229 the male was in a range of 0.45-0.74, and the highest value and lowest of condition factor values were  
230 found in June, 2017 and April, 2018, respectively. The condition factor of the female was in a range  
231 of 0.39-0.70, and the highest value and lowest of condition factor values were found in October, 2017  
232 and April, 2018, respectively. According to our study, the condition factor in giant snakehead fish  
233 slightly changed during an annual observation due to this fish species generally live in the wetland all  
234 years long.

#### 235 **7. The relationship between the body and intestinal lengths and stomach content index**

236 The longest and shortest intestinal length of fish were 16.95 and 48.00 cm, respectively; and  
237 average of intestinal length was  $30.16 \pm 12.04$  cm. The ratio of the body and intestinal length of giant  
238 snakehead fish was 1: 0.70 (Table 4). The type of stomach content examined in 230 fish displayed  
239 that only 24 fish of which stomach contained the digesta; and the stomach of the other 206 fish  
240 contained no digesta. The components of stomach content included fish fillet, small fish and digested  
241 content which was not able to be identified due to the complete digestion. The portion of a total  
242 stomach content, counted as 100%, comprised of 51.8% of fish fillet, 30.3% of small fish and 17.9%  
243 of digested content (Figure 7). The ratio of the body and intestinal length (1: 0.70) of giant snakehead  
244 fish was in a range of the carnivore fish. Likewise, the stomach digesta components found in this  
245 study indicates that the feeding behavior of giant snakehead fish has not changed which is carnivore  
246 fish.

247

#### 248 **Conclusion**

249 Based on the results of the annual survey from April, 2017 to March, 2018 in Huai Suea  
250 wetland, there were 36 fish species belonging to 17 families were observed in 10 sampling sites.  
251 Three Chanidae fishes, namely snakehead fish (*Channa striatus*), giant snakehead fish (*Channa*  
252 *lucius*), and forest snakehead fish (*Channa micropeltes*), belonging to the family Chanidae were  
253 reported. A total of 230 giant snakehead fish were found in this survey which consisted of 118 males



254 and 112 females. The sex ratio (male: female) was 1: 0.95. The GSI value of the female was higher  
255 than that of the male that indicates the gonad of female is greater level of gonad development than  
256 that of male. The body length and body weight of a total of 230 giant snakehead fish observed in this  
257 study showed that the longest and shortest body lengths of fish were 14.3 and 73.3 cm, respectively;  
258 and the average of a total body length was  $43.71 \pm 11.72$  cm. The heaviest and lightest body weights  
259 of fish were 125 and 1,254 g/fish, respectively; and the average of the body weight was  $448 \pm 173$   
260 g/fish. The condition factors of giant snakehead fish observed in 12 months were in a range of 0.45-  
261 0.74% for the male and 0.39-0.70% for the female. The ratio of the body and intestinal length of giant  
262 snakehead fish was as 1: 0.70. The stomach digesta components of this fish species consisted of  
263 51.8% of fish fillet, 30.3% of small fish and 17.9% of digested digesta.

264

265

#### 266 **Ethical Approval:**

267

268 As per international standard written ethical approval has been collected and preserved by the  
269 author(s).

270

#### 271 **Conflict of interest**

272 None

273

#### 274 **Reference**

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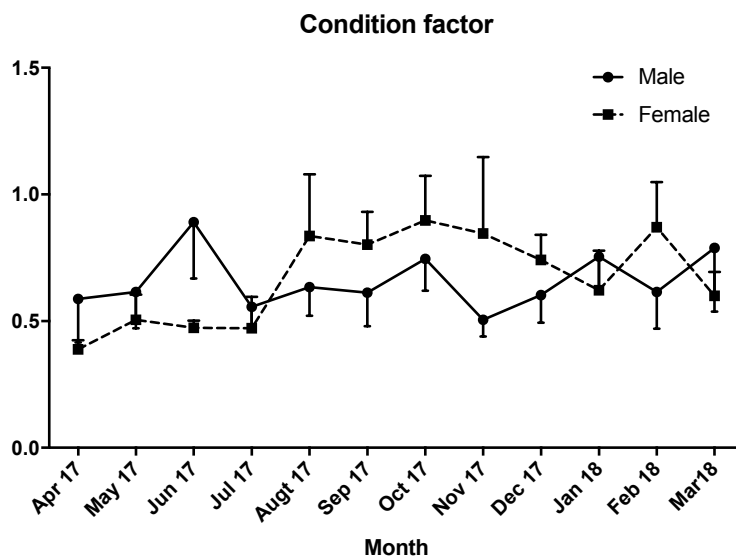


296  
297 **Figure 1** Ten sampling sites (10 sites) where the samples were collected in Huai Suea Ten  
298 wetland, Nam Phong District, Khon Kaen Province

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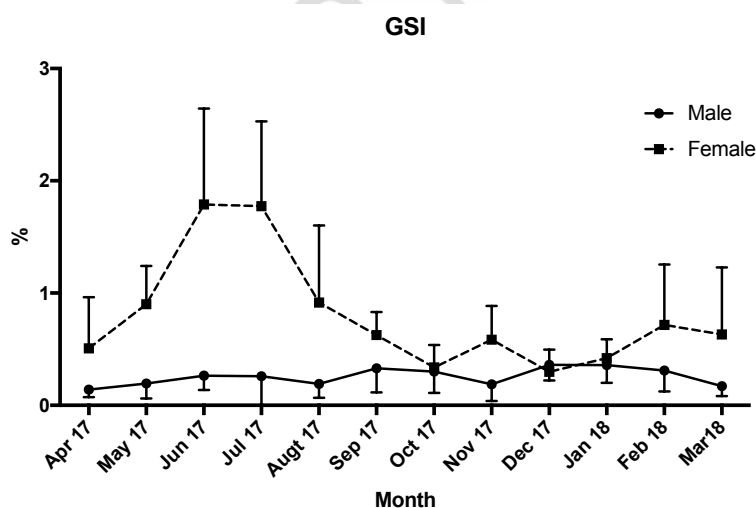
302 **Figure 2** Giant snakehead fish (*Channa micropeltes*)

303

304 **Figure 3** the tendency of the condition factor (K) of the giant snakehead fish of male and  
 305 female in Huai Suea Ten wetland, Nam Phong District, Khon Kaen Province from April,  
 306 2017 – March, 2018 (The error bars are the standard deviation.)

307

308



309

310 **Figure 4** Gonadosomatic index (%) of the giant snakehead fish of male (n = 118) and female  
 311 (n = 112) in Huai Suea Ten wetland, Nam Phong District, Khon Kaen Province from April,  
 312 2017 – March, 2018 (The error bars are the standard deviation.)

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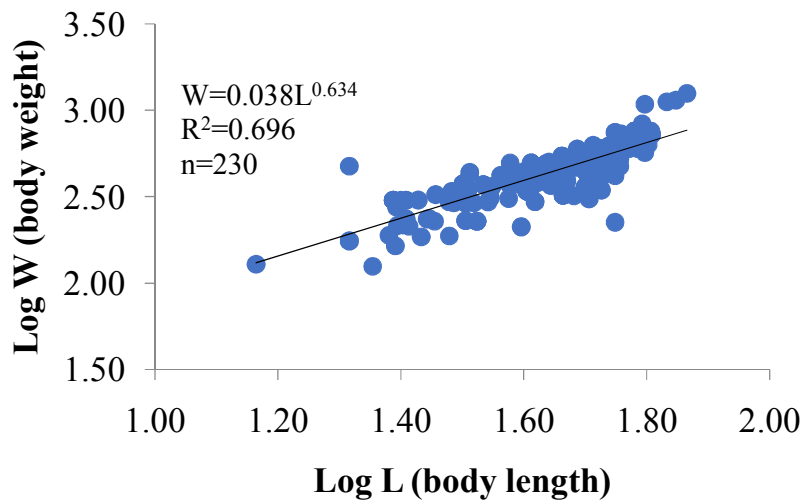
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316 **Figure 5** the difference of urogenital pore of giant snakehead fish collected during the pairing  
 317 season in Huai Suea Ten wetland, Nam Phong District, Khon Kaen Province (left = male;  
 318 right = female)

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320

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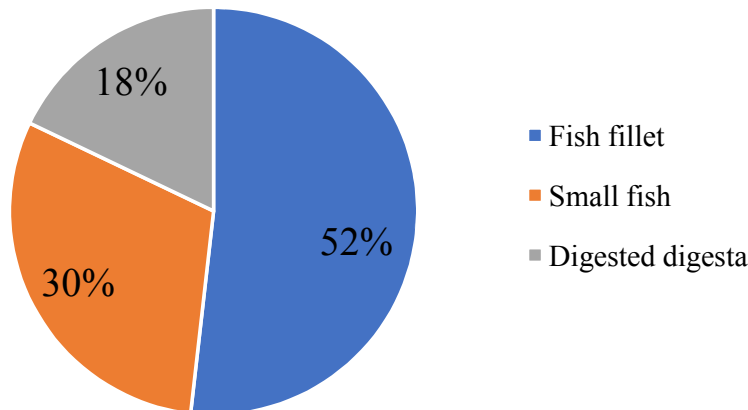
322

323 **Figure 6** the relationship between the body length and body weight of giant snakehead fish  
 324 ( $R^2 = 0.696$ ) in Huai Suea Ten wetland, Nam Phong District, Khon Kaen Province collected  
 325 from April, 2017 – March, 2018

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327

328



329

330 **Figure 7** The type of and amount of stomach content of Giant snakehead fish (n = 230); the  
 331 values are expressed as percentage (%) of a whole stomach digesta as the digesta weight.

332

333 **Table 1** The fish species were observed in all sampling site in Huai Suea Ten wetland, Nam  
 334 Phong District, Khon Kaen Province

Family	Subfamily	Scientific name		
Notopteridae		<i>Notopterus notopterus</i>		
Cyprinidae	Rasborinae	<i>Esomus metallicus</i>		
		<i>Rasbora rubrodorsalis</i>		
		<i>Rasbora borapetensis</i>		
	Cyprininae	<i>Cyclocheilichthys apogon</i>		
		<i>Osteochilus hasselti</i>		
		<i>Labiobarbas spilopleura</i>		
		<i>Puntioplites proctozysron</i>		
		<i>Puntius leiacanthus</i>		
		<i>Puntius gonionotus</i>		
		<i>Hampala dispar</i>		
		<i>Cirrhinus molitorella</i>		
		Channidae		<b><i>Channa striata</i></b>
				<i>Channa lucius</i>
	<i>Channa micropeltes</i>			
Anabantidae		<i>Anabas testudineus</i>		
		<i>Trichopsis vittatus</i>		
		<i>Trichogaster trichopterus</i>		

	<i>Trichopsis pumila</i>
	<i>Betta smaragdina</i>
Cobitidae	<i>Lepidocephalus hasselti</i>
	<i>Acanthopsis choirorhynchos</i>
Siluridae	<i>Ompok bimaculatus</i>
	<i>Kryopterus bleekeri</i>
Ambassidae	<i>Parambassis siamensis</i>
Nandidae	<i>Nandus nebulosus</i>
Belonidae	<i>Xenentodon cancila</i>
Bagridae	<i>Mystus vittatus</i>
	<i>Mystus nemurus</i>
Clariidae	<i>Clarias batrachus</i>
Symbranchidae	<i>Monopterus albus</i>
Tetrodontidae	<i>Tetrodo nleirus</i>
Mastacembelidae	<i>Macrogathus siamensis</i>
Pristolepidae	<i>Pristolepis fasciatus</i>
Cichlidae	<i>Oreochromis niloticus</i>
Eleotridae	<i>Oxyeletris marmoratus</i>
<b>Total = 17 families</b>	<b>36 species</b>

335

336

337

338 **Table 2** the sex ratio of Giant snakehead fish collected in Huai Suea Ten wetland, Nam

339 Phong District, Khon Kaen Province from April, 2017 – March, 2018

Month/year	Fish number		Total	Sex ratio		Chi-square	H <sub>0</sub>
	Male	Female		Male	Female		
April 17	10	10	20	1	1.00	0.014	accept
May 17	13	8	21	1	0.62	0.945	accept
June 17	10	8	18	1	0.80	0.130	accept
July 27	8	7	15	1	0.86	0.025	accept
August 17	10	7	17	1	0.70	0.385	accept
September 17	9	14	23	1	1.56	1.364	accept
October 17	9	9	18	1	1.00	0.012	accept
November 17	6	12	18	1	2.00	2.327	accept
December 17	9	11	20	1	1.22	0.318	accept
January 18	16	9	25	1	0.56	1.613	accept
February 18	11	6	17	1	0.55	1.222	accept
March 18	7	11	18	1	1.57	1.111	accept
<b>average</b>				1	0.95	9.465	accept
<b>total</b>	118	112	230				

340 **Note:** Chi-square at the confident 95% df1 = 3.84, df11 = 19.68

341

342

343

344

345 **Table 3** the condition factor (K) of the giant snakehead fish of male and female collected  
 346 between April 2017 – March 2018

Month/year	Male				Female			
	Fish number	Length (cm)	weight (g)	K	Fish number	Length (cm)	weight (g)	K
April 17	10	47.2	472.96	0.45	10	47.2	409.49	0.39
May 17	13	46.9	492.01	0.48	8	48.8	518.83	0.45
June 17	10	37.4	387.18	0.74	8	48.0	541.38	0.49
July 17	8	42.9	407.58	0.52	7	53.5	629.81	0.41
August 17	10	46.4	532.15	0.53	7	41.6	449.10	0.62
September 17	9	46.4	500.59	0.50	14	38.7	381.56	0.66
October 17	9	41.2	442.44	0.63	9	36.9	353.81	0.70
November 17	6	45.2	439.77	0.48	12	42.2	426.33	0.57
December 17	9	43.9	436.57	0.51	11	39.3	386.36	0.64
January 18	16	41.7	416.39	0.58	9	45.8	471.16	0.49
February 18	11	46.6	478.70	0.47	6	37.4	362.39	0.69
March 18	7	42.9	423.33	0.54	11	44.9	469.31	0.52
<b>Average</b>		44.05	453.61	0.54±0.08*		43.35	442.84	0.55±0.11*
<b>Total</b>	118				112			

347 \* The mean value ± standard deviation

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357 **Table 4** the ratio of body length and intestinal length of giant snakehead fish in Huai Suea  
 358 Ten wetland, Nam Phong District, Khon Kaen Province collected from April, 2017 – March,  
 359 2018

<b>Class interval of length (cm)</b>	<b>Fish number</b>	<b>Body length (cm)</b>	<b>Intestinal length (cm)</b>	<b>Ratio of body and intestinal length</b>
20.0 – 29.9	19	23.90	16.95	1 : 0.71
30.0 - 39.9	58	33.22	22.46	1 : 0.68
40.0 – 49.9	97	44.66	28.31	1 : 0.63
50.0 - 59.9	47	52.86	35.08	1 : 0.66
60.0 – 69.9	9	61.80	48.00	1 : 0.78
<b>Average</b>		43.29±15.11*	30.16±12.04*	1 : 0.70
<b>Total</b>	230			

360 \* **The mean value** ± standard deviation

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